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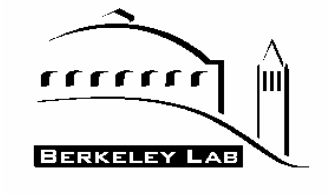

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

ENVIRONMENT, SAFETY, & HEALTH SELF-ASSESSMENT REPORT FISCAL YEAR 2004

Environment, Health, and Safety Division
Office of Assessment and Assurance
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APPENDICES

Executive Summary

All divisions at the Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) have effective Environment, Safety, and Health (ES&H) programs that follow the requirements of Integrated Safety Management (ISM).

All divisions participate in the annual Division Self-Assessment. The divisions regularly integrate ES&H considerations into work planning, actively identify and analyze hazards, and effectively control these hazards through administrative and engineering means. LBNL staff performs work safely, and ES&H feedback and improvement mechanisms are robust.

Four divisions received Integrated Functional Appraisals (IFAs) this self-assessment year: Computing Sciences/Directorate, Engineering, Environmental Energy Technologies (EETD), and Physical Biosciences (PBD). The IFAs performed in 2004 concluded that all operations requiring formal authorizations have the appropriate and current formal authorizations. These authorizations are conscientiously followed.

The LBNL Safety Review Committee (SRC) reviewed the Management of Environment, Safety, & Health (MESH) in five divisions this year: Accelerator and Fusion Research (AFRD), Earth Sciences (ESD), Facilities, Engineering, and Nuclear Science (NSD). The MESH reviews determined that all divisions have adequate division ISM plans that are effectively implemented.

During the 2004 fiscal year, the LBNL ES&H Self-Assessment Program received official certification from the Department of Energy (DOE) that denotes an effective and model program. The official certification followed a site visit from a team of DOE staff and contractors. The team recognized two significant strengths of the LBNL Self-Assessment Program: (1) a strong management commitment and (2) a multitiered approach that allows for flexibility and provides thoroughness in reviews. The team also identified areas of improvement, recommending that LBNL strengthen requirements, use the Laboratory Corrective Action Tracking System (LCATS), and increase staff supervisory and self-assessment training.

The performance-year 2004 Self-Assessment process noted deficiencies that should be addressed institutionally. These opportunities for improvement are:

- **Tracking and Resolving Safety Deficiencies.** Although divisions continue to improve in this area, use of LCATS remains inconsistent. Also, some divisions continue to struggle with resolving safety deficiencies tracked in LCATS. Finally, divisions must track opportunities for improvement identified during the previous self-assessment cycle in LCATS.

- **Occupational Safety and Health Administration (OSHA) Deficiencies.** OSHA deficiencies are common in division workspaces. Self-assessment inspection teams, especially division self-assessment and Environment, Health, and Safety (EH&S) subject matter expert teams, must inspect workspaces to ensure compliance with OSHA standards. In striving to prevent future OSHA violations, self-assessment teams must receive training in OSHA standards, and divisions must be diligent in properly implementing corrective actions.

- **Ergonomic Workstation Evaluations.** Ergonomic workstation evaluations are not regularly performed in several divisions. These divisions should proactively focus on staff who have received recommendations for ergonomic evaluations, as ergonomic hazards remain a contributing source of Laboratory staff injuries.

Introduction

LBNL's ES&H Self-Assessment Program ensures that ISM is implemented institutionally and by all divisions. The Self-Assessment Program, managed by the Office of Assessment and Assurance (OAA), provides for an internal evaluation of all ES&H programs and systems at LBNL. The functions of the program are to ensure that work is conducted safely and with minimal negative impact to workers, the public, and the environment. The program is composed of four distinct assessments: the Division Self-Assessment, IFA, the MESH review, and the Appendix F Self-Assessment.

The *Division Self-Assessment* uses the five core functions and seven guiding principles of ISM as the basis of evaluation. Metrics are created to measure performance in fulfilling the five core functions and seven guiding principles of ISM, as well as promoting compliance with applicable regulations.

The five core functions of ISM are:

1. Define the Scope of Work
2. Identify and Analyze Hazards
3. Control the Hazards
4. Perform the Work
5. Feedback and Improvement.

The seven guiding principles of ISM are:

1. Line Management Responsibility for ES&H
2. Clear Roles and Responsibilities
3. Competence Commensurate with Responsibilities
4. Balanced Priorities
5. Identification of EH&S Standards and Requirements
6. Hazard Controls Tailored to the Work Performed
7. Operations Authorization.

Performance indicators are developed by consensus with OAA, division representatives, and EH&S Division program managers. Line management of each division performs the Division Self-Assessment annually. The focus of the review is workplace safety.

The *IFA* is an in-depth ES&H technical review of division work activities and operations. The focus of the IFA is on higher-hazard work, particularly work requiring formal authorizations. The assessment concentrates on adequacy of authorizations, effective control of hazards, balance of operation and safety priorities, and applicability of institutional standards and regulatory requirements. The IFA is conducted by EH&S Division technical experts. Each division receives an IFA triennially.

The *MESH review* is an evaluation of division management of ES&H in its research and operations, focusing on implementation and effectiveness of the division's ISM plan. It is a peer review performed by members of the LBNL Safety Review Committee (SRC), with staff support

from OAA. The SRC includes representation from each science and operations division at LBNL. Each division receives a MESH review every two to four years, depending on the results of the previous review.

Information obtained from the Division Self-Assessments, IFAs, and MESH reviews address performance requirements in the UC/DOE Contract 98 *Appendix F Self-Assessment*. The Division Self-Assessment performance criteria, in particular, are closely aligned with the performance objectives, criteria, and measurements (POCMs) of Appendix F. The Appendix F POCMs are based on the core functions and guiding principles of ISM. Additional information required for Appendix F is provided by EH&S Division functional managers. The Appendix F Report annual report is submitted at the close of the fiscal year. This assessment is the DOE's primary mechanism for evaluating the Laboratory's contract performance for ISM.

Throughout the following discussion, the following abbreviations are used for certain LBNL divisions: AFRD (Accelerator and Fusion Research Division), ALS (Advanced Light Source), CSD (Chemical Sciences Division), EETD (Environmental Energy Technologies Division), EH&S (Environment, Health, and Safety Division), ESD (Earth Sciences Division), LSD (Life Sciences Division), MSD (Material Sciences Division), NSD (Nuclear Science Division), PBD (Physical Biosciences Division), and PGF (Production Genomics Facility).

DOE Certification of ES&H Self-Assessment Program

LBNL's ES&H Self-Assessment Program received official DOE Certification in December 2003. The DOE Certification signifies that LBNL has an effective self-assessment program that is a model for the entire complex. LBNL is the only DOE site to achieve this certification. The certification is based on a set of twelve certification metrics adapted from the Institute of Nuclear Power Operators principles for self-assessment. DOE staff and contractors representing several DOE sites developed the performance metrics.

LBNL submitted to DOE a report that evaluated the Self-Assessment Program against the certification metrics, and identified program strengths and weaknesses. After reviewing the report, DOE determined that LBNL was a candidate for certification. DOE assembled a Self-Assessment Certification Team of two DOE Office of Environment, Safety, and Health staff and two contractors with experience directing ES&H programs at Office of Science laboratories. The team spent a week at LBNL observing self-assessment program activities, interviewing LBNL managers and staff, and reviewing documents.

The team recognized two significant strengths to the LBNL Self-Assessment Program. First, the team noted that a strong management commitment to self-assessment is evident. The program emphasizes continuous improvement and holds staff accountable for their performance. Second, the Self-Assessment Program has a multitiered approach that allows for flexibility to adjust to changing trends and provides thoroughness in reviews. The team also identified well-defined performance metrics, annual reports, and communication mechanisms as program strengths.

The team identified areas of improvement involving corrective action tracking and training. The specific findings and the corrective actions implemented by LBNL are as follows:

- **Program documents are unclear on divisional requirements for using LCATS.** LBNL revised LBNL/PUB-5344, LBNL/PUB-3105, and LBNL/PUB-3111 to require all divisions to use LCATS to track ES&H findings. The 2004 Division Self-Assessment Performance Metrics measured this requirement.
- **Revise definitions of hazard levels 2 (medium) and 3 (low) in LCATS.** The definitions of hazard levels 2 and 3 were revised in LBNL/PUB-5344 and LBNL/PUB-3105 to encourage categorizing more items as hazard level 2. The new hazard levels were discussed at multiple Division Safety Coordinators' meetings.
- **Trending and root-cause analysis are not regularly performed on hazard level 3 (low) LCATS.** The database was modified to allow for easier trending of hazard level 3 entries. OAA performs quarterly trending. When trends are established, root-cause analysis is performed.
- **LCATS is not used for programmatic findings from MESH reviews, IFAs, and other assessments.** All divisions agreed to begin tracking programmatic findings in LCATS. The 2004 Division Self-Assessment Performance Metrics measured this requirement.

- **Require EHS020 training (ES&H for Supervisors) for all supervisors.** EHS020 is required for all Operations division supervisors. All science divisions specified requirements for supervisors in their respective division ISM plans.
- **Consider requiring EHS799 training (ES&H Self-Assessment) for all self-assessment participants.** EHS799 is required for all Division Safety Coordinators. Safety coordinators target other staff to receive EHS799.

LBNL met with the DOE ES&H Self-Assessment Certification Board at DOE Headquarters in Washington, D.C. The Board consisted of the DOE Office of Science Chief Operating Officer, the DOE Office of Environment, Safety, and Health Assistant Secretary, and the San Diego Gas & Electric Director Emeritus. The Board reviewed the LBNL ES&H Self-Assessment Program and the corrective actions implemented in response to the Certification Team findings. Satisfied with the status of the program, the Board certified the LBNL ES&H Self-Assessment Program.

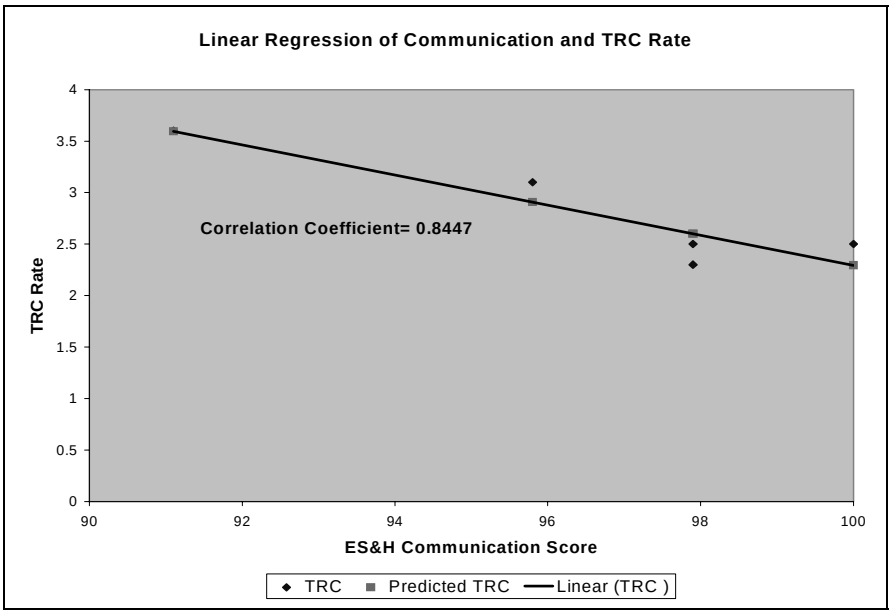
Linking Leading and Lagging Indicators

During the 2004 fiscal year, LBNL conducted statistical analyses to determine if performance in leading indicators affected injury and accident rates. This analysis was done in consultation with Dr. Yung Jae Lee of St. Mary's College in Moraga, California. Based on the assumption that one year's safety culture affects the next year's injury and accident rates, LBNL compared self-assessment results from one year with injury rates from the next year. For example, the 2000 self-assessment results were compared to the 2001 Total Recordable Case (TRC) and Days Away, Restricted, or Transferred (DART) rates to determine if a direct correlation exists. This analysis considered the self-assessment results from 1998 through 2002 and compared them to the TRC and DART rates from 1999 through 2003.

LBNL ran linear regressions of selected division self-assessment metrics as the predictor variable, and TRC and DART rates as the response variable. These regressions revealed that statistically significant relationships exist between:

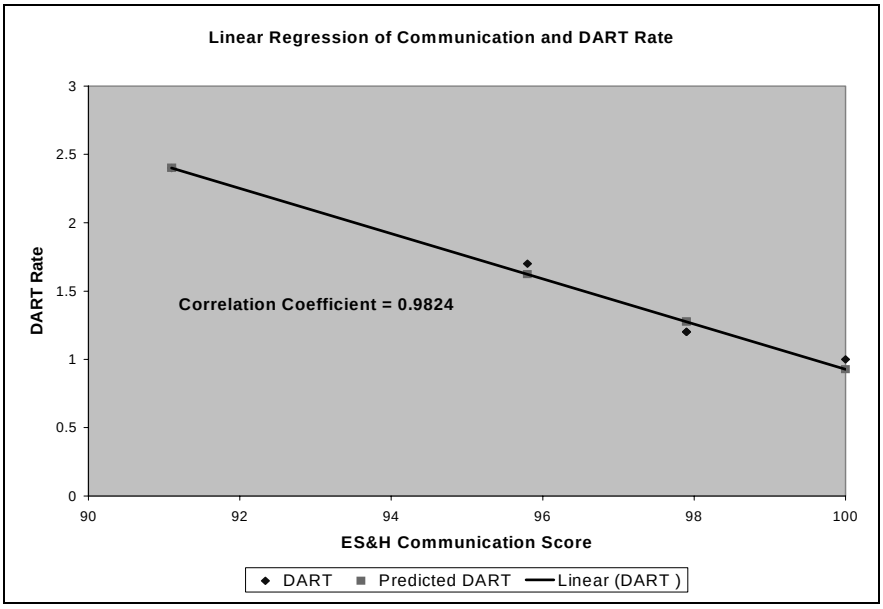
1. The ES&H communication metric and TRC,
2. The ES&H communication metric and DART,
3. The line management involvement metric and TRC, and
4. The line management involvement metric and DART.

Linear regression graphs of the four relationships follow:

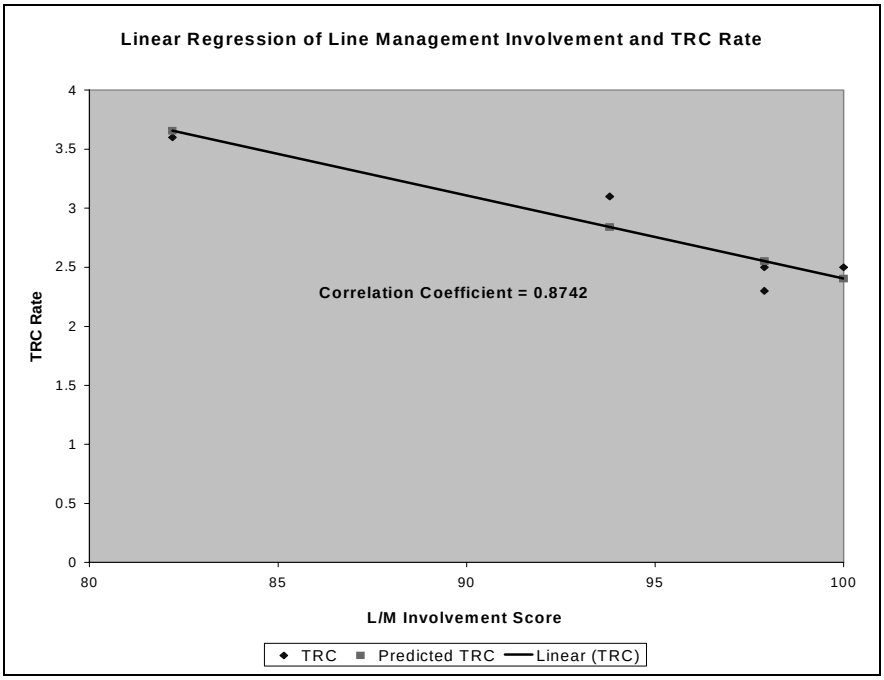


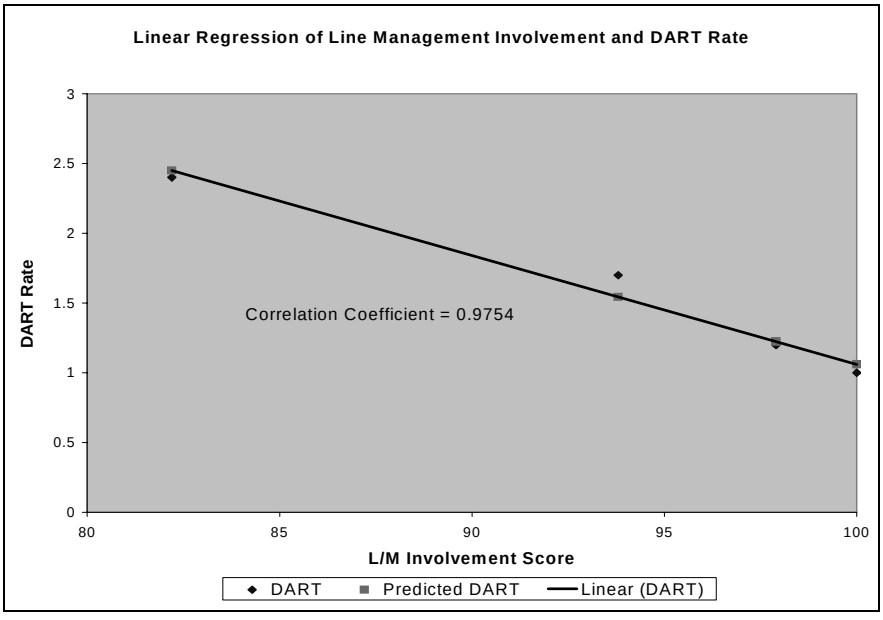
The graph above displays predicted TRC rates that, based on the previous year's ES&H communication metric average score, are in very close proximity to the actual TRC rates. This is

because the correlation coefficient[1] between the communication metric score and the TRC rate is very high. In fact, the correlation coefficient for each of these four relationships is very strong (above 0.84 in each case), demonstrating a close correlation between performance in the two leading indicators (communication and line management involvement) and injury and accident rates (TRC and DART).



[1] The correlation coefficient is a measure of how well trends in predicted values follow trends in actual values in the past. It is a measure of how well the predicted values from a forecast model "fit" with real-life data. The correlation coefficient is a number between 0 and 1. No relationship between the predicted values and the actual values yields a correlation coefficient of close to 0 (the predicted values are no better than random numbers). As the strength of the relationship between the predicted values and actual values increases, so does the correlation coefficient. A perfect fit gives a coefficient of 1.0. Thus, the higher the correlation coefficient, the better.





This study provides statistical evidence that line management involvement and ES&H communication are vital to reducing injuries and accidents. Divisions can drive down the rate of injuries and accidents by effectively performing these two activities. Work is performed more safely when line managers demonstrate the importance of ES&H through active involvement in the division safety program. Staff work more safely when engaged through robust and regular ES&H communications that allow for information to flow from managers to line staff, and vice versa.

Division Self-Assessments

Performance Rating

Each division's ES&H performance rating is based on a color-coded system of determining whether each performance criterion and expectation is fully met, partially met, or marginally met. Points are assigned for the three performance gradients, and a percent performance is calculated for each performance indicator and for overall division performance. A green rating, which means division performance is within the range of excellent to outstanding for an expectation, is worth three points. A division is assigned two points for a yellow rating, which means it is partially meeting performance requirements for the metric. A red rating, which is worth one point, communicates that a division's performance is marginal for a performance indicator. Finally, a gray rating denotes that a performance metric is not applicable to the division. Rating determinations for each performance metric are detailed in Appendix B.

Performance Results

The Division Self-Assessment performance criteria and expectations are used to evaluate the effectiveness of each division's ISM program. ISM provides the foundation for the divisions' ES&H programs. Each division performs self-assessment activities throughout the fiscal year. At the end of the fiscal year, each division prepares a report that summarizes these activities and appraises their ES&H performance. OAA reviews these reports and validates the division performance in meetings with division and DOE representatives.

ISM Core Function 1: Define Work

Divisions regularly integrate ES&H considerations into work planning. All divisions allocate resources at appropriate levels to address ES&H considerations. Divisions have staff dedicated to manage their ES&H programs and provide funding to implement improvements and resolve deficiencies. A primary focus of funding is resolving workspace safety deficiencies detected through self-assessment and OSHA inspections. Divisions also allocate funding to improve workstations to control ergonomic hazards. All divisions have effective mechanisms for communicating ES&H policy and concerns to staff. Communication is two-way; while division management communicates ES&H issues to staff, staff have avenues to express concerns to management. This methodology ensures a robust system of ES&H communication.

ISM Core Function 2: Identify and Analyze Hazards

All divisions actively identify and analyze hazards. Each division inspects all of its staff workspaces annually. Divisions use different methods of inspecting workspaces. In some divisions, such as AFRD, ALS, and PBD, all staff participates in workspace inspections. Others, such as EH&S, Engineering, and MSD, rely on self-assessment teams to inspect all workspaces. Finally, in several divisions, including Chemical Sciences, EETD, ESD, and LSD, line managers perform the primary inspections. In fact, most divisions have redundant inspection programs that use aspects of each of the three methods described. This results in highly effective inspections, with different parties of diverse expertise and perspectives inspecting the same workspaces. The

inspections focus on two areas: (1) identifying workspace hazards and (2) recording and resolving safety deficiencies.

An OSHA sitewide audit in January 2004 recorded 2,303 OSHA violations. This is despite the efforts of division self-assessment and EH&S subject-matter-expert teams, which inspected all LBNL workspaces and discovered and resolved over 1,500 safety deficiencies during the fiscal year. The self-assessment inspections focused on perceived safety hazards, not on strict compliance with OSHA regulations. This resulted in many findings, including a large number of electrical and machine guarding deficiencies that were in violation of OSHA standards. Self-assessment inspection teams, especially division self-assessment and IFA teams, must inspect workspaces to ensure compliance with OSHA standards. In striving to prevent future OSHA violations, self-assessment teams must receive training in OSHA standards, and divisions must be diligent in properly implementing corrective actions.

Hazards inherent in staff workspaces and activities are well documented. Most divisions use the Hazards, Authorizations, and Review (HEAR) database to inventory hazards. A few divisions use systems tailored to best address their hazards, such as programmatic hazard reviews.

ISM Core Function 3: Control Hazards

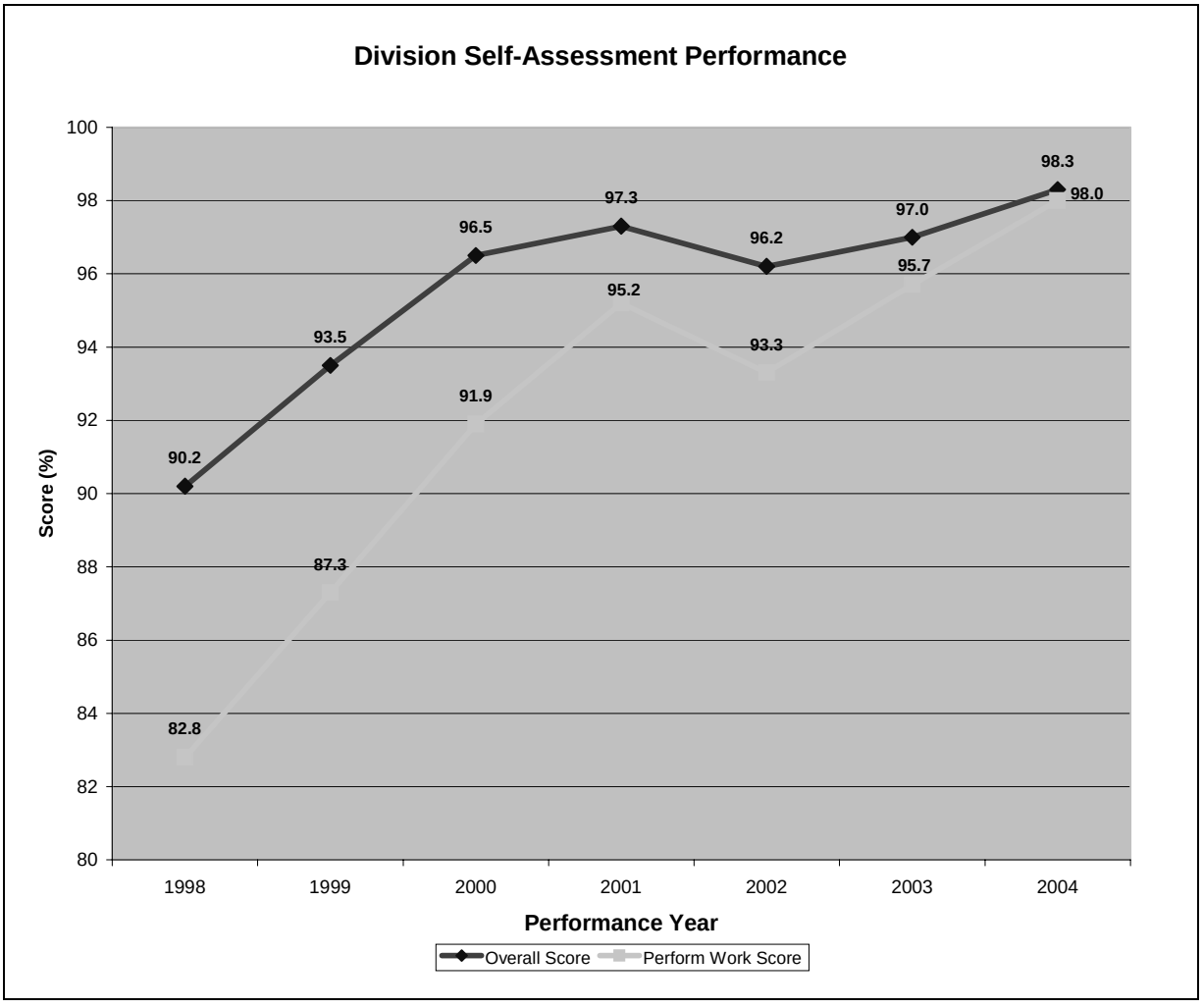
Divisions are effectively controlling hazards through engineering and administrative means. Fume hoods, gloveboxes, gas monitors, and other engineering controls are routinely checked as part of division self-assessment inspections. When engineering controls are not calibrated and serviced on schedule, divisions are diligent in contacting EH&S Division staff to service the equipment.

Divisions use formal authorizations and self-authorizations to control hazards administratively. Divisions review work to determine if formal authorizations are required. The divisions are conscientious in performing these reviews. Once formal authorizations are established, divisions must review and renew these authorizations on schedule. With few exceptions, formal authorizations are reviewed and renewed as required. Most divisions use the HEAR database to certify that hazards are controlled. LSD, NSD, and Physics require a hazard inventory for each project with signed certifications that these hazards are controlled. In NSD and Physics, the division safety committees review these signed project reviews.

Divisions are also focusing on distinct forms of hazards, including ergonomics and peroxide-forming chemicals. All divisions with peroxide-forming chemicals had these items labeled and tested as required. Divisions are diligent in requiring staff to take EHS060, Ergonomics for Computer Users; however, several divisions are not proactive in performing ergonomic evaluations. When evaluations are performed, most divisions are successful in implementing recommended improvements. Several scientific divisions, including LSD, NSD, PBD, Physics, and Genomics, concentrate on ergonomic hazards in laboratories; this represents an evolution of divisions' ergonomic programs beyond computer workstations.

ISM Core Function 4: Perform Work

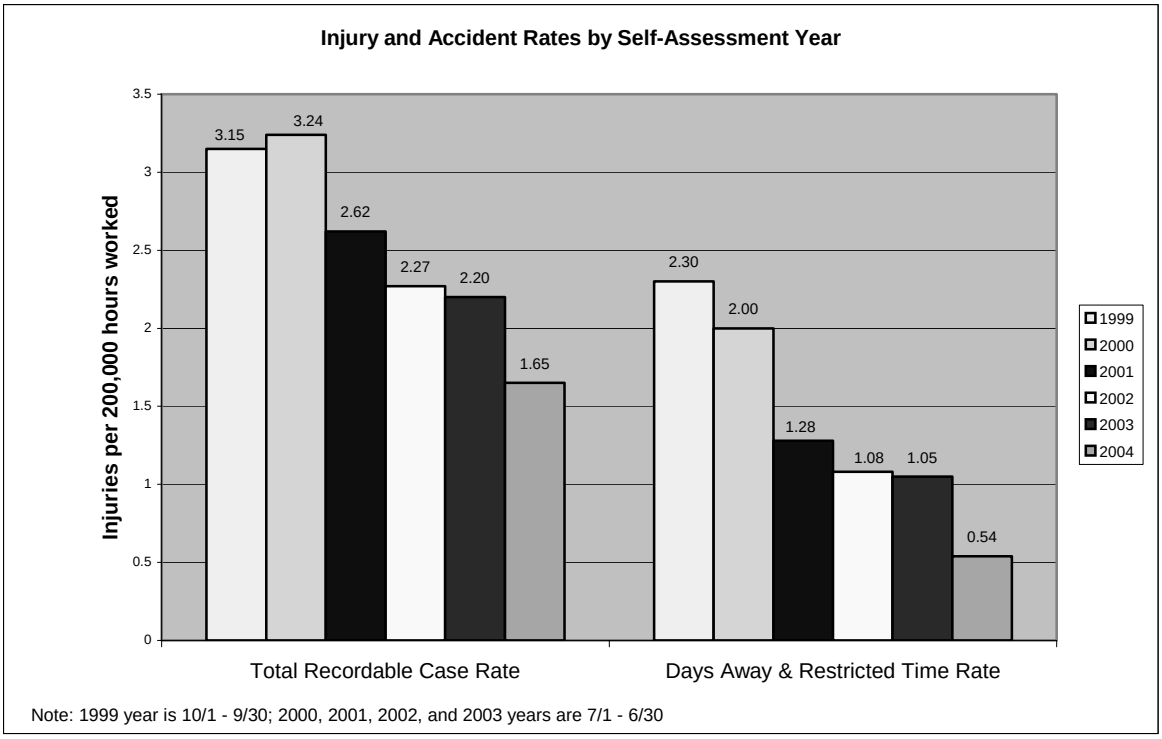
The Laboratory-wide results in the Perform Work metrics, an aggregate score of 98.0%, indicate LBNL's best performance in the seven years of the current division self-assessment methodology. While the Laboratory-wide performance in this core function has trended upward for seven years, this is the first year where the score for the Perform Work metric essentially mirrors the overall Division Self-Assessment score of 98.3%. Spurred by the improvement in Perform Work results, this overall Division Self-Assessment score is the highest on record. The following chart details the improvements in the overall Division Self-Assessment scores and the Perform Work scores in the last seven years.



The most significant improvement in divisions' performance is in the injury and accident metrics. Both the TRC rate and DART rates declined dramatically since last year. The 2003 average divisional scores for the TRC and DART metrics were 79.2% and 91.7%, respectively. In 2004, the average divisional scores for both TRC and DART increased to 95.8%. This remarkable improvement is due to significantly reduced injury and accident rates in Computing

Sciences, EH&S, Engineering, Facilities, NSD, PBD, and PGF. Most other divisions maintained very low injury and accident rates. Notably, AFRD, CSD, and ESD had zero recordable injuries for the second straight year.

The Laboratory-wide continuous improvement in TRC and DART rates over the last several years is displayed in the following chart. The Laboratory-wide TRC rate for the 2004 fiscal year[2] decreased 25% from the 2003 TRC rate, and nearly 50% from the 2000 TRC rate. The DART rate has shown even greater improvement, with the 2004 DART rate dropping almost 50% from the 2003 DART rate, and over 75% from the 1999 DART rate.



Divisions continued to perform well in all other Perform Work metrics. Divisions effectively manage their hazardous, radioactive, and mixed wastes, and are pursuing waste minimization opportunities. Staff are well trained, and with few exceptions, work is performed within authorization requirements.

ISM Core Function 5: Feedback and Improvement

All divisions have active feedback and improvement mechanisms in their ES&H programs. Senior and line management are involved in all divisions, participating in workspace inspections, safety committees, and accident review boards. Senior and line managers also play vital roles in divisions' ES&H communications through division all-hands meetings, and department, project, and group meetings.

[2] Self-assessment fiscal year is July 1, 2003 to June 30, 2004. The fiscal year 2004 (October 1, 2003 – September 30, 2004) TRC and DART rates are 1.20 and 0.42, respectively.

Divisions are reviewing injury and accident reports, ensuring that accident causes and appropriate corrective actions are recorded. Divisions are moving away from accident review boards, and instead focus on the Division Safety Coordinator and EH&S Division liaison meetings with injured staff and the respective supervisor. Senior managers often participate in these meetings.

Most divisions are successfully recording workspace safety deficiencies and tracking these deficiencies to resolution in the LCATS database. As divisions perform thorough reviews of their workspaces, they note all safety deficiencies not immediately resolved; however, use of LCATS is very inconsistent. Some divisions are very diligent in tracking safety deficiencies in LCATS, while other divisions only track some findings. Physics did not track any workspace deficiencies in LCATS during the 2004 fiscal year. Once findings are entered into LCATS, most divisions are highly successful in addressing these issues in a timely manner; however, a couple of divisions have struggled to close findings by the target end dates. This is due to several reasons: some findings require significant funds or take a long time to fix, and in some cases, division staff do not prioritize implementing corrective actions. In almost all cases, these are low-level hazards that do not compromise workplace safety. Despite these flaws, divisions are generally improving the process of tracking and resolving safety findings. AFRD, ALS, Engineering, Facilities, MSD, and PBD all identified and tracked well over 100 safety deficiencies in their staff workspaces. By aggressively detecting and mitigating safety issues, safety conditions in LBNL activities and workspaces have steadily improved.

Divisions also use LCATS to track safety-system oriented deficiencies identified during the 2003 self-assessment year. Each division tracked these findings, identified in the MESH, IFA, and division self-assessments, in the LCATS database. During the course of the 2004 self-assessment year, most divisions were successful in resolving these issues. In a few cases, divisions did not adequately address findings, and continue to work on these findings during the 2005 fiscal year. Directorate/Business Services Division made noteworthy improvements to their safety program as a result of the 2003 assessments. They have significantly improved their communication mechanism, safety committee, and management involvement.

Best Practices

While all divisions have effective ISM programs, a few divisional practices are noteworthy for their demanding expectations and innovations. Best practices include activities involving all staff, proactive ergonomic hazard control programs, and highly effective safety committees.

AFRD and ALS Quality Assurance/Improvement and Environment, Safety, and Health through Self-Assessment and Teamwork (QUEST) programs involve all division personnel, including employees, matrixed staff, visitors, temporary employees, students, and participating guests. In both divisions, all staff members are assigned to a QUEST team. Each QUEST team is required to conduct an annual workspace inspection with a formal inspection checklist. Safety deficiencies from this process are tracked in LCATS. This has proven extremely successful, as AFRD tracked 262 findings, and ALS tracked 252 findings. Each team is also required to conduct an annual safety meeting. All team members should have an active role in the QUEST activities, either by participating in inspections and meetings, writing policies and procedures, or recording team

activities. The QUEST program assures AFRD and ALS division management that all staff are engaged in the ES&H program.

EETD and Computing Sciences have had proactive, aggressive ergonomics programs for several years. The ergonomic programs of these two divisions remain models for all other divisions. EETD developed an ergonomics action plan in 1999. The plan focuses on training, workstation evaluations, and workstation upgrades. EETD was one of the first divisions to require EHS060 training, and today, 90% of staff has completed this course. The plan also called for staff to complete an ergonomic survey. An ergonomics sub-committee used these results to prioritize actions to address the survey findings. To date, 171 staff members have received ergonomic workstation evaluations, and 51 workstations have been upgraded. Senior management monitors this program, as the Division Safety Coordinator provides quarterly progress reports to the Division Director.

Computing Sciences was the first division to require EHS060 training for all staff, and 91% of staff has completed this training. Computing Sciences is also the only Laboratory division to require ergonomic workstation evaluations for all staff and evaluations for all staff moves. As a result, 80% of staff has had an ergonomic workstation evaluation. Computing Sciences also provides workstation evaluations for staff with home workstations through the use of workstation photos and videoconferences. This is an innovative approach to a challenge faced by all divisions.

The Physical Biosciences Division decontaminated all accessible surfaces of Calvin Laboratory in an effort to control legacy radioactive contamination. The planning process for this project was an excellent implementation of ISM. The division has a very strong safety program, with roles and responsibilities for the safety team clearly defined. This helped in providing staff with regular updates on the locations affected and project progress, ensuring that impacts to regular operations were minimized. The project involved a systematic approach of identifying hazards by inspecting every room to detect legacy radioactivity. The hazards were well controlled, as a Radiological Work Permit (RWP) detailed the scope and procedures for the decontamination process. The project was completed with no radiological incidents, an outstanding achievement considering the breadth of activities. Because of the decontamination process, the radiological posting requirements for Calvin Laboratory were reduced, which resulted in only specific areas of the building posted as controlled areas. Previously, the entire building was posted as a controlled area. The new posting requirements allow for easier access for visitors and students who attend classes and seminars at Calvin. This also promotes the LBNL mission by easing barriers to collaborative research projects.

Opportunities for Improvement

The most significant opportunity for improvement identified in the Division Self-Assessment process is tracking and resolution of workspace safety deficiencies. Use of the LCATS database is very uneven, with some divisions tracking dozens of findings and other divisions tracking very few findings. In addition, a few divisions do not track all inspection findings in LCATS; instead, they only track findings from select inspections. Divisions must diligently record and track all inspection findings not immediately resolved in LCATS, including opportunities for improvement identified in the previous self-assessment cycle. The Laboratory should strive to

achieve greater consistency in use of LCATS, which can be accomplished by providing greater support to the division safety programs that use LCATS. Division EH&S liaisons and OAA should work with the divisions to ensure that all findings are entered into the database, and that findings are resolved in a timely manner. In addition, the Laboratory should consider improving the LCATS database by streamlining the entry process for findings. This will improve efficiency of managing the database, and encourage divisional use.

Another opportunity for improvement is that, in many divisions, ergonomic workstation evaluations are not emphasized. While all divisions ensure that staff complete EHS060 (Ergonomics for Computer Users), workstation evaluations are not regularly performed in many divisions. In six divisions, less than 50% of staff recommended for workstation evaluations has completed this training (EHS068, Ergonomic Workstation Evaluation). While the Laboratory does not mandate ergonomic evaluations, divisions must do a better job of identifying high-risk staff and performing requisite ergonomic evaluations.

Integrated Functional Appraisals (IFAs)

IFAs evaluate higher-hazard and complex operations that demand subject matter expertise from the EH&S Division. A focus of the IFA is authorization compliance. The following divisions received an IFA during the 2004 fiscal year:

Division	IFA date
Computing Sciences/Directorate	March 2004
Engineering	August 2004
Environmental Energy Technologies	August 2004
Physical Biosciences	August 2004

IFA Results

IFAs performed in 2004 concluded that all operations requiring formal authorizations have the appropriate and current formal authorizations. These authorizations are conscientiously followed. Each division's management expressed strong support for ES&H. This results in regular workspace inspections and safety-conscious staffs. Workspaces are generally well maintained, with a backlog of OSHA deficiencies being the primary concern. Noteworthy practices and opportunities for improvement for each of the four assessed divisions are listed in Appendix C.

Common noteworthy practices from the four IFAs are the following:

1. The divisions have proactive ES&H programs. The PBD safety team is proficient in identifying and correcting ES&H deficiencies. Engineering focuses on authorization compliance, with dedicated inspections for assuring that operations are maintained within authorized controls. EETD has an ergonomic safety committee that stresses workstation evaluations and implementation of corrective actions.

2. The divisions manage their high-hazard operations effectively. Computing Sciences has extensive procedures for high-hazard areas of the Oakland Scientific Facility and the Halon systems in Buildings 50A and 50B. Engineering has exemplary management of the Building 77 ultra-high vacuum cleaning facility, the Building 25 photo fabrication area, and the associated fixed wastewater treatment units at each location.

Each IFA identified opportunities for improvement in the assessed divisions. A common finding is OSHA deficiencies in division workspaces. Multiple appraisals noted that machine guarding is an issue in shop areas, with unguarded moving parts. Also, electrical deficiencies are common. Relocatable power taps are used in place of permanent wiring, and safety showers/eyewashes are installed near energized circuits.

Safety Review Committee (SRC) Management of ES&H (MESH) Reviews

The SRC conducts reviews of each division's MESH in operations and/or research, focusing on the implementation and effectiveness of each division's ISM Plan. For FY04, the SRC conducted MESH reviews in the following divisions:

Division	MESH review date
Accelerator and Fusion Research	May 2004
Earth Sciences	May 2004
Facilities	May 2004
Engineering	June 2004
Nuclear Science	July 2004

The MESH reviews determined that all divisions have adequate division ISM plans that are effectively implemented. Management commitment is vital in all divisions, with senior managers who regularly participate in safety activities — communications, committee meetings, and workspace inspections. Line management accountability for ES&H is growing, as line managers participate in inspections and accident investigations, and receive performance reviews that consider staff safety.

Common noteworthy practices found include:

1. Management support for safety is strong in all divisions. Division management, including the division directors, participates in regular workspace inspections. In AFRD and Earth Sciences, senior managers are on the safety committees. Meaningful safety leadership from the division directors has resulted in improved ES&H cultures in Earth Sciences and Engineering.
2. Scientific divisions are developing laboratory-specific safety binders. Both Earth Sciences and Nuclear Science have safety binders tailored to the unique hazards of each lab. These binders include authorizations, training requirements, on-the-job training, and LBNL safety procedures.
3. Divisions are performing regular, aggressive workspace inspections. AFRD, Earth Sciences, and Engineering have well established inspection programs. Facilities Workers Observing Workers program is an effective method of identifying safety hazards inherent in Division work activities.

4. Matrixed staff is accounted for in divisions' ES&H programs. AFRD, ALS, and Engineering have an established Memorandum of Understanding (MOU) detailing the safety responsibilities of matrixed staff. In AFRD and Engineering, matrixed staff are included in all regular safety communications.

Common deficiencies from the five divisions are listed below.

1. Seismic concerns. AFRD has significant institutional seismic deficiencies inherent in much of their staff workspace, as large parts of Building 58 and the Building 71 complex are not structurally sound. Building 25, which houses Engineering staff and operations, also has seismic deficiencies. Nuclear Science has many cabinets and pieces of equipment that require seismic bracing.
2. LCATS database usage is inconsistent among divisions. AFRD and Engineering use LCATS very aggressively to record safety deficiencies. However, many of these deficiencies remain unresolved for extended periods of time. Facilities does not enter all inspection findings into the database. Nuclear Science is very uneven in their use of LCATS, as most of the findings recorded in 2002 remain unresolved, and the Division recorded no findings in 2003. All divisions must use LCATS to record safety deficiencies not immediately corrected, and must diligently close these findings with expediency.
3. Hazard controls for self-authorized work are not as rigorous as hazard controls for formally authorized work. In Engineering, self-authorized work reviews are not documented or reviewed by management. In Facilities, hazards for small jobs are not always communicated to line workers. In Nuclear Science, ergonomic evaluations are proceeding slowly.

Noteworthy practices and opportunities for improvement identified in each assessment are provided in Appendix C.

ES&H Improvements

Status of FY03 Self-Assessment Corrective Actions

Each year, as a result of the annual ES&H self-assessment reports, the Laboratory identifies institutional issues that require management action. The status of the corrective actions for the institutional issues identified in the FY03 ES&H Self-Assessment Report is described below.

1. Laser safety

The laser safety program has implemented the following improvements:

- EH&S is currently writing a chapter in LBNL/PUB-3000 that will cover all interlocks at LBNL.
- The required laser safety retraining is a Web-based training course from Lawrence Livermore National Laboratory. LBNL has modified this training to meet LBNL requirements and specifications. The resulting course is easier for LBNL staff to use and understand.
- Two laser labs that had safety deficiencies were addressed. The resolutions included upgrading an interlock system and improving signage to better delineate a laser beam-path.
- The LBNL Safety Review Committee required all divisions to forward their laser activity hazard documents (AHDs) to the laser safety officer for review during FY04.

2. Formal authorizations

- The institutional AHD database is migrating to a Web-based system. This will improve communications between EH&S and division line management by allowing divisions to upload authorizations directly to the database and renew authorizations online. This process will ensure that the EH&S Division is aware of all AHDs and can monitor the renewal process.

3. Division injury and accident reduction programs

- Engineering and Facilities Divisions worked closely with the EH&S Division in a concerted effort to reduce staff injuries. Both divisions experienced significant improvements in injury and accident rates. Engineering decreased recordable injuries by almost 70%, while Facilities reduced recordable injuries by 14%. Two other divisions identified as having elevated recordable injury rates, EH&S and PGF, also reduced recordable injuries.

FY04 Recommendations for Institutional Improvements

Based on the results of the FY04 Division Self-Assessments, IFAs, and the SRC MESH reviews, the following opportunities for institutional improvement are recommended:

1. Tracking and Resolving Safety Deficiencies

- Use of the LCATS database is very inconsistent among divisions. While many divisions track dozens of safety findings in LCATS, a few divisions track very few deficiencies. Some divisions only track findings from select inspections in LCATS. Divisions must track all safety deficiencies not immediately resolved in the LCATS database.

- Divisions continue to struggle with resolving safety deficiencies tracked in LCATS. While funding constraints may play a role in a few cases, in most cases divisions have not properly prioritized resolving safety deficiencies, with findings remaining open for extended periods of time.

- Divisions must track opportunities for improvement identified during the previous self-assessment cycle in LCATS. Addressing these opportunities is an excellent form of continuous improvement, and divisions must ensure that these opportunities are properly monitored and resolved.

2. OSHA Deficiencies

- IFAs noted OSHA deficiencies in division workspaces. Machine guarding is an issue in shop areas, with unguarded moving parts. Electrical safety deficiencies are also common, as relocatable power taps are used in place of permanent wiring, and safety showers/eye-washes are installed near energized circuits. Self-assessment teams require education and training to identify OSHA deficiencies in workspaces.

3. Ergonomic Workstation Evaluations

- Ergonomic workstation evaluations are not regularly performed in several divisions. These divisions should proactively focus on staff who have received recommendations for ergonomic evaluations. Ergonomic hazards remain a contributing source of Laboratory staff injuries, as 25% of recordable injuries in FY04 were due to repetitive motion.

Appendix A

FY04 Division Self-Assessment Performance Criteria

EXPECTATION	VALIDATION	RATING
DEFINE WORK		
E1. Resources are effectively allocated to balance ES&H, programmatic, and operational considerations.	V1. Are resources allocated to address ES&H considerations?	satisfactory - green partial - yellow marginal - red
E2. Line management regularly communicates ES&H policy, procedures, and lessons learned to all staff. Division staff has clear lines of communication to convey ES&H issues to Laboratory and Division management, including evidence of clear policy for all staff to communicate safety concerns. Examples of appropriate communication/policy include: • Annual all-hands division meeting • Active Division Safety Committee • Group safety meetings • Division ES&H Web site • Roles and responsibilities detailed in ISM plan • Division-wide emails	V2. Is ES&H discussed in ongoing meetings between line management and staff? Is process systematic?	satisfactory - green partial - yellow marginal - red

EXPECTATION	VALIDATION	RATING
IDENTIFY HAZARDS		
E3. Workspaces are inspected and evaluated on a regular basis.	V3. % Division workspace inspected	>90% - green >70% - <90% - yellow <70% - red
E4. Divisions have a process to identify, analyze, and categorize hazards associated with work. Examples of hazard inventory include: • HEAR database • project safety review • workspace safety review	V4. For all Division projects, programs, and operations, have hazards been identified and inventoried? Does inventory include both new work and modification of existing work?	satisfactory - green partial - yellow marginal - red
CONTROL HAZARDS		
E5. Divisions ensure engineering and other safety controls are in place and maintained. Examples of engineering controls include, but are not limited to: • guards • fume hoods • interlocks • personal protective equipment • gas monitors	V5. Are engineering controls monitored as part of division self-assessment program? Are controls certified/checked, calibrated, and/or serviced within the required schedule?	satisfactory - green partial - yellow marginal - red
E6. Divisions ensure administrative controls are in place and maintained. Examples of administrative controls for self-authorized work include: • work procedures • project safety reviews • assurance letters	V6. Are hazards controlled for all Division projects? Are administrative controls reviewed annually and when work is modified? This includes work under formal authorizations (e.g., AHDs, RWAs) and self-authorized work (i.e., Division approval only).	satisfactory - green partial - yellow marginal - red
E7. Divisions ensure that ergonomic issues are effectively addressed for work processes and staff workstations.	V7. Does the Division have an active ergonomic program for its employees, including ergonomic training (i.e., EHS060, EHS052, EHS062), evaluations, and controls for work processes and workstations? Are evaluation recommendations implemented?	satisfactory - green partial - yellow marginal - red

EXPECTATION	VALIDATION	RATING
	CONTROL HAZARDS	
E8. Divisions ensure that peroxide-forming chemicals are effectively controlled. Examples of controls include: • Locations and owners of peroxide-forming chemicals are identified. • Peroxide-forming chemicals are labeled in accordance with the Chemical Hygiene and Safety Plan. • Peroxide-forming chemicals are tested in accordance with the Chemical Hygiene and Safety Plan.	V8. Does the Division have a program to control peroxide-forming chemicals?	satisfactory - green partial - yellow marginal - red
	PERFORM WORK	
E9. Work is performed within the ES&H conditions and requirements specified by Laboratory policies and procedures.	V9a. Work within authorization: % SAA compliance (MWSAAs, RWCAs).	*regulatory driven* >90% - green >75% - <90% - yellow <75% - red
	% Authorization compliance (i.e., RWAs, RWPs, XAs, AHDs)	*regulatory driven* >90% - green >75% - <90% - yellow <75% - red
	% compliance QA waste samples	*regulatory driven* >95% or only 1 failure - green >92% - <95% - yellow <92% - red
	# Waste Management–issued NCARs	*regulatory driven* 0 - green type 1* - yellow type 2 [@] - red

EXPECTATION	VALIDATION	RATING
PERFORM WORK		
	V9b. Injuries and Accidents: Is TRC rate under 2.62 or evidence of divisional improvement?	*contract driven* TRC >25% below 2.62 or 20% improvement or 1 case/yr - green TRC <25% below/above 2.62 or 10% improvement or 2 cases/yr - yellow TRC >25% above 2.62 - red
	Is LWC rate under 1.50 or evidence of divisional improvement?	*contract driven* DART >25% below 1.50 or 20% improvement or 1 case/yr - green DART <25% below/above 1.50 or 10% improvement or 2 cases/yr - yellow DART >25% above 1.50 - red
E10. Staff is proficient in performing work safely.	V10a. % completion of JHQs or equivalent system.	>90% - green >80% - <90% - yellow <80% - red
	V10b. Based on JHQs or training profiles, % completion rate for required courses.	>90% - green >80% - <90% - yellow <80% - red
E11. Divisions review at least one research or Operations process. Reviews are documented and , if possible, waste-reduction strategies implemented.	V11. 1) Divisions demonstrate progress in minimization opportunities identified in FY04 self-assessment. 2) Divisions review at least one research or operations process. Reviews are documented and , if possible, waste reduction strategies implemented. Divisions include waste minimization in division project review protocols. 3) Divisions that generate no regulated waste pursue minimization opportunities for other wastes (paper, batteries, toner, etc.).	satisfactory - green partial - yellow marginal - red

EXPECTATION	VALIDATION	RATING
FEEDBACK AND IMPROVEMENT		
E12. Managers and staff are regularly involved in ES&H feedback and improvement activities.	V12. Do line management (including division directors, principal investigators, and senior/mid managers) and staff participate in feedback and improvement activities (i.e., walkthroughs, programmatic safety review, and other ES&H activities)?	satisfactory - green partial - yellow marginal - red
E13. ES&H deficiencies identified from workspace inspections, self-assessment activities, and external appraisals are corrected in a timely manner. A downward trend of Level 1 and 2 LCATS repeat deficiencies is established.	V13. % completion rate of LCATS corrective actions (Levels 1, 2, and 3) implemented in a timely manner.	>90% - green >80% - <90% - yellow <80% - red
E14. ES&H programmatic deficiencies identified from MESH Reviews, IFAs, and previous Division Self-Assessments are corrected in a timely manner.	V14. % completion rate of programmatic corrective actions identified during MESH Reviews, IFAs, and previous Division Self-Assessment implemented in a timely manner.	>90% - green >80% - <90% - yellow <80% - red
E15. Division performs thorough review of all staff injuries and accidents, including analysis of conditions that led to injury and implementation of corrective actions.	V15. Has Division ensured that accident causes and corrective actions for first aid and recordable injuries are effectively identified on SAARs? Are corrective actions implemented?	satisfactory - green partial - yellow marginal - red

Appendix B

FY04 Division Self-Assessment Performance Ratings

Criteria	Expectations \ Divisions	AFRD	ALS	Chemical Sciences	Computing Sciences	Directorate	EH&S	Engr	Environ. Energy Tech	ESD	Facilities	LSD	MSD	Nuclear Sciences	Phys Biosci.	Physics	PGF	Expectation Score
1	Resources allocated to address ES&H considerations.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
	Evidence of strong ES&H communication.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
2	% Work space inspected.	100%	100%	100%	100%	100%	100%	100%	100%	100%	>90%	100%	100%	100%	100%	100%	100%	100%
	Hazards identified and inventoried.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
3	% Engineering controls certified and calibrated.	100%	100%	100%	100%	N/A	100%	100%	99%	100%	100%	100%	99%	96%	100%	97%	100%	100%
	Administrative controls appropriate and maintained.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partial	97.9%
	Evidence of an effective ergonomics program.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.0%
	Peroxide forming chemicals are controlled	Yes	N/A	Yes	N/A	N/A	Yes	N/A	Yes	Yes	N/A	Yes	Yes	Yes	Yes	N/A	Yes	100%
4	% SAAs in compliance.	100%	100%	100%	N/A	N/A	100%	100%	93%	98%	93%	95%	93%	100%	100%	100%	100%	100%
	% Authorized work w/o major deficiencies.	95%	100%	100%	N/A	N/A	82%	100%	100%	93%	100%	98%	100%	95%	100%	100%	100%	97.6%
	% QA compliance rate.	100%	100%	96%	N/A	N/A	100%	100%	98%	100%	100%	97%	98%	97%	97%	100%	N/A	100%
	# NCARs.	0	0	0	N/A	N/A	0	0	0	1	0	0	0	0	0	0	0	95.2%
	Injury & accident case rate (TRC).	0.00	1.28	0.00	1.07	2.57	2.51 26% imp.	1.00	1.44	0.00	5.85 14% imp.	1.63	1.33	0.00	0.00	0.00	1.74	95.8%
	Days Away & Restricted Time (DART)	0.00	0.00	0.00	0.00	0.21	0.00	0.33	0.48	0.00	4.29 11% imp.	0.00	0.00	0.00	0.00	0.00	1.74	95.8%
	% Job hazard questionnaire (JHQ) completed.	94%	99%	93%	93%	96%	99%	100%	95%	96%	>90%	90%	95%	97%	97%	90%	96%	100%
	% Completion rate of required courses.	93%	95%	90%	95%	89%	95%	93%	91%	92%	95%	93%	93%	94%	94%	90%	97%	97.9%
	Waste minimzation (haz., rad., mixed, & sanitary).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
5	Managers and staff involved in ES&H feedback and improvement.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
	Workspace safety LCATS completion rate.	82%	90%	93%	100%	100%	96%	83%	91%	94%	98%	100%	100%	100%	100%	Marginal	100%	91.7%
	Programmatic LCATS resolved	Partial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Partial	Yes	93.8%
	SAARs properly completed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
	Division Score	96.8%	100%	100%	100%	95.6%	98.4%	98.3%	100%	96.8%	96.7%	100%	100%	98.4%	100%	95.0%	96.7%	98.3%

Appendix C

FY04 Self-Assessment

Noteworthy Practices and Opportunities for Improvement

Division	Review	Noteworthy Practices	Opportunities for Improvement
Accelerator and Fusion Research	Division SA	• AFRD staff has worked over four years without a recordable injury or lost-work-time accident. • AFRD has a well-established system of communicating ES&H issues. The Division has two safety committees, one that includes representatives of all programs and another that includes senior managers, which are vital to the communication process. In addition, QUEST teams meet regularly to discuss safety concerns. • Division staff is extremely active in discovering workspace safety deficiencies. Division staff recorded 262 findings in 2004. This active safety culture is reflected in the achievement of zero recordable injuries.	• The Division is not effectively implementing recommendations from ergonomic evaluations. Only 65% (15 out of 23) of workstation evaluations have implemented all recommendations. • While AFRD is commended for discovering 262 safety deficiencies, the Division lacks resources to properly address all findings. Only 82% of LCATS findings were resolved in a timely manner.
	MESH	• The Division appreciates a special responsibility for student safety. All students complete the JHQ and all required training. Supervisors are held accountable for the safety training of their students. The L'OASIS project diligently tracks the safety training of their	• AFRD has significant space limitations, which could be partially alleviated by eliminating equipment no longer in use. • AFRD has some significant safety challenges in some of the buildings they occupy.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Accelerator and Fusion Research (continued)		students, which number from 15 to 20 annually. • AFRD works closely with staff from ALS and Engineering Divisions. This relationship results in many staff matrixed among the three organizations. All three divisions proactively assign safety responsibilities for matrixed staff between home and host divisions. The three divisions have formal agreements for the safety of matrixed staff incorporated into their ISM Plans. • Senior Division management takes an active role in staff safety. Division praxis, as stated by the Division Director, is that "safety is a form of respect." The Division ES&H Committee is chaired by the Division Director and includes all program heads and project leads. All division managers participate on QUEST teams. • AFRD has a bilateral MOU with Oak Ridge National Laboratory regarding training of staff working at each other's facility. AFRD accepts some Oak Ridge training for their staff working at LBNL, and Oak Ridge accepts some LBNL training for staff working with AFRD. This is a proactive measure that increases cooperation between the two institutions without sacrificing safety. • Division management holds line management accountable for staff safety during the annual	Buildings 58 and 71 have pressing seismic deficiencies, resulting in large portions of these buildings remaining unoccupied. The Laboratory should work to resolve these conditions, which put a considerable strain on the Division's operations.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Accelerator and Fusion Research (continued)		performance review process. The respective staff ES&H performance accounts for 10 to 15 percent of each line manager's annual performance rating. • The Division's ES&H management structure is highly effective. The Division Safety Coordinator and Division ES&H Administrator have distinct yet complementary roles. In particular, the Division ES&H Administrator is vital to the continued excellence of AFRD's safety program.	
Advanced Light Source	Division SA	• Each experiment receives an experiment safety review. These reviews are documented and posted near the experiment location. This is an excellent form of self-authorization. • QUEST activities are an excellent form of staff involvement. Through these activities, all staff participate in workspace inspections and regular safety meetings. • ALS identified 252 findings through various inspections during the year. Of these findings 90% were recorded in a timely manner. • Management is actively involved in the safety program, participating in various safety-related activities, workspace inspections, and safety meetings. One of the QUEST teams is a dedicated management team.	• ALS should place greater emphasis on ergonomic training and evaluations. Only 17 staff members (out of 52) recommended for ergonomic evaluations have done so. • ALS should record findings from previous self-assessment activities in LCATS to ensure these findings are properly tracked and resolved.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Chemical Sciences	Division SA	• Chemical Sciences has formed a Safety Management Team that consists of the Division Deputy, EH&S Division Liaison, and Division Safety Coordinator. This team functions well and is the driving force behind the Division's safety program. • CSD is very systematic in tracking and resolving safety deficiencies. All findings that resulted from self-assessment inspections, OSHA inspections, and last year's self-assessment process were diligently tracked. Most of these findings have been resolved.	
Computing Sciences	Division SA	• Computing Sciences has the most proactive ergonomics program at the Laboratory. Ergonomic evaluations are required for all staff, the only division with this requirement. 91% of staff has completed EHS060, and 80% has completed EHS068. The Division also works to evaluate workstations at employees' homes. • Computing Sciences tracks and resolves safety deficiencies very effectively. 158 findings were recorded in LCATS this year, with all findings resolved. • Management is actively involved in the safety program. Senior and line management inspected 100% of staff workspace. Also, management is represented on the Division safety committee.	• Computing Sciences should review the safety committee charter to ensure that (1) committee members are charged with communicating ES&H issues to and from staff and (2) all staff are represented. • The hazard identification and inventory process should be more systematic.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Computing Sciences (continued)		• Computing Sciences has considered its operations and taken the appropriate measures to ensure the safety of personnel and the prevention of untoward incidents in the performance of work. The procedure for disabling the Halon systems in 50B-1275 and 50A-1156 is an example of this proactive approach.	
	IFA	• Oakland Scientific Facility operations have been assessed with an eye for personnel safety. Care is taken to provide good procedures, which are available and up to date. Responsible personnel are knowledgeable and responsive.	
Directorate/ Ops	Division SA	• ES&H communication is much improved over last year. The communication process is very systematic, and staff is regularly engaged. The Line Managers Safety Committee, which includes representatives from all Directorate and Business Services Division groups, provides an excellent mechanism for two-way ES&H communication. • BSD/Directorate has made Ergonomics for Supervisors a mandatory training class for the 2005 fiscal year. • BSD/ Directorate has been aggressive in addressing the opportunities for improvement identified in last year's self-assessment	• The total recordable case rate has improved since last year, largely because of the organization's ergonomic initiatives. However, the TRC rate is still elevated compared to most divisions. • Only 89% of required staff training is completed. Supervisors should be more vigilant in directing staff to complete training.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Directorate/ Ops (continued)		process. This has resulted in the formation of two new safety committees, a new workspace inspection program, and several ergonomic initiatives. Though two of the findings are not resolved, they are on track for implementation in 2005.	
Earth Sciences	Division SA	• Each lab maintains a Laboratory Safety Binder that identifies lab-specific hazards and controls. • For the second straight year, ESD had zero recordable or lost-work-time injuries. • Management involvement is outstanding. All line managers and department heads participate in semiannual inspections of staff workspace. In addition, the Division Director attends every Division Safety Committee meeting and interviews each injured employee. • ESD has resolved seven of the eight observations and concerns addressed in the FY04 MESH review. This demonstrates a proactive approach to managing safety.	• ESD had one NCAR because waste was stored in an SAA for greater than one year. Better tracking and control of SAAs is required.
	MESH	• Earth Sciences Division has an extremely functional health and safety Web site that is	• One ESD principal investigator was not conversant in safety regulations and

Division	Review	Noteworthy Practices	Opportunities for Improvement
Earth Sciences (continued)		readily accessible to all Division personnel. The Web site not only provides a myriad of useful ES&H information for Division personnel but also the necessary mechanisms to ensure that personnel are identifying the hazards in their work environment, fulfilling their training requirements, and becoming familiar with required safe practices and work controls. The Web site is a model for other divisions. • The Division Director and the Division Safety Coordinator have been instrumental in changing the safety culture of the Division. New initiatives, such as the Ergonomic Pilot Initiative and the Laboratory Primer, have been successful due in large part to the Division Director's active support and the Safety Coordinator's diligent and proactive work. • To address a concern raised in the last MESH review, the Division now clearly identifies the lines of authority for safety. Each employee has one departmental supervisor who is the employee's ES&H supervisor. For laboratory space, a single principal investigator is designated as the laboratory ES&H lead responsible for safety in that space, even if the laboratory is shared. • Laboratory primers are in place at the laboratories visited by the MESH team. The primers are excellent and easy-to-use documents that introduce safety requirements and information to new and existing Laboratory	responsibilities and, in particular, requirements for the use of radioactive materials. The researcher stated that the lab's RWA was inactive, yet the dry waste containers were in use. The researcher could not articulate clearly the use of radioactive material in the lab. • Although the OSSEPP form states that first aid, CPR, and fire extinguisher training are mandatory for all off-site participants, a review of personnel training records shows a very low completion rate for these three training courses. ESD has indicated that these courses are not necessary for off-site work, and that the OSSEPP form will be revised to delete these requirements. The Division should seek further input from EH&S subject matter experts for other training that can be tailored to site-specific hazards, such as blood-borne pathogens.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Earth Sciences (continued)		personnel. Each primer covers the ESD Integrated Safety Management Plan, listing of ES&H resources at LBNL, training requirements, emergency contacts, and general lab safety and waste management procedures. • To address ergonomic issues raised from the last MESH review and past self-assessment findings, the Division has aggressively pursued workstation evaluations and upgrades for its personnel. The Division has not incurred any ergonomic-related recordable injuries for the past two years. • The Division has an aggressive workspace inspection program that likely contributed to the relatively low number of findings from the recent OSHA inspection in January (ESD incurred only 20 of the >2,000 total findings). • The Division is very receptive and effective in addressing findings and concerns from past MESH reviews, IFAs, and division self-assessments.	
Engineering	Division SA	• Engineering has dedicated funds for self-assessment activities and LCATS resolutions. • Engineering has an active ergonomics program. 93% of staff has completed EHS060, and 94 staff workstations were evaluated for ergonomic concerns. Recommendations are effectively implemented. • Engineering Division's injury reduction program has been highly successful. The	• Only 83% (161 out of 194) LCATS findings were resolved. While Engineering is commended for diligently recording safety deficiencies, resolving these findings merits greater attention.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Engineering (continued)		Division has reduced the number of staff injuries significantly over the last few years. This year the Division had three recordable injuries and a TRC of 1.00, much lower than previous years. • Engineering has partnered well with EH&S to reduce generation of hazardous waste. Most oil absorbents and rags are recycled rather than disposed. The Division continues to pursue innovative waste reduction opportunities.	
	MESH	• Engineering staff, especially staff in the shops, indicated that safety is discussed regularly, if not daily, before projects or work activities begin. Even matrixed employees, whose supervisors are at other locations, are communicating/checking with their supervisors on a frequent basis and reviewing safety concerns before work commences. • The core safety management team, in particular the Division Safety Coordinator, are knowledgeable and assertive in addressing and resolving Engineering safety issues. • During a period of reorganization, reduction in workforce, and fundamental changes in the conduct of its operations, Engineering has been able to maintain a work environment relatively free of uncontrolled hazards. It is noteworthy that in spite of these changes, the workplace	• Hazard review of projects that do not require formal authorizations are not documented or reviewed by Division management. The Division's policy is that line managers are responsible for the safety review of all potentially hazardous activities. However, there is little documentation that such reviews are occurring regularly and with appropriate rigor.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Engineering (continued)		continues to be a safe and protected environment for the employees. • For the current performance period, Engineering has significantly reduced its injury accident rates. The Division has only two recordable injury cases for the year to date. In comparison, the Division had 11, 14, and 11 recordable cases for FY01, FY02, and FY03, respectively. The Division has active teams, composed of the Safety Coordinator, the EH&S Liaison, the cognizant Division Deputy, the injured employee, and the supervisor to investigate each accident regardless of its severity. • The new Division Director is very much involved in the day-to-day operations of the safety program. He works closely with the Division safety management team. He also has an "open-door" policy for Division staff to meet with him to discuss any safety issues that they might have.	
	IFA	• The Division Safety Coordinator and his assistant conduct formal reviews of hazards and verify that they are properly documented in the HEAR database. This is done while the Engineering Division Self-Assessment Team reviews the corresponding spaces for compliance with Berkeley Lab EH&S requirements. This is an excellent mechanism for assuring that operations are maintained	• Engineering has a large backlog of OSHA machine-guarding deficiencies. The Division should address machine-guarding issues on a priority basis.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Engineering (continued)		within the authorized framework. • The Division suspended operation of the PRISM laser system temporarily while the authorization had lapsed during the renewal process. This is an excellent mechanism for assuring that operations requiring formal authorizations meet Laboratory requirements. • The nature of the work in the ultra-high vacuum cleaning facility in Building 77, the photo fabrication area in Building 25, and the associated fixed wastewater treatment units pose significant EH&S challenges. EH&S management of these facilities is exemplary.	
EETD	Division SA	• EETD has developed an off-site safety review form to identify and control hazards that arise in projects outside of the Laboratory. • The Division has a very proactive ergonomics program that includes an ergonomic action plan overseen by an ergonomics action committee. This approach has resulted in very high rates of training completion and workstation evaluations. In addition, 51 workstations were recently upgraded. • Line management is very involved in the ES&H program. The Division Director and department heads participated in workspace safety inspections. The Division Director led three division council meetings and an all-	

Division	Review	Noteworthy Practices	Opportunities for Improvement
EETD (continued)	IFA	hands meeting with safety on the agenda. • Seismic safety concerns were aggressively addressed since the last IFA. Very few seismic-related deficiencies were noted in the 2004 IFA. • Housekeeping has improved dramatically as a result of Division management's involvement. For example, operations were suspended in a problematic wet chemistry laboratory until the area was cleaned. After inspection of the area, operations were allowed to resume, but only after the area supervisor developed a plan of action to maintain his area to Division standards. • Ergonomics has improved as a result of the Division's focus on evaluating workstations and providing funds to correct deficiencies.	• Electrical safety issues include inappropriate use of extension cords, damaged electrical cords, improper cable trays bonding/ grounding, and blocked electrical disconnects and panels. Several eyewash/ safety showers or drench hoses are located near energized circuits. This was noted during the previous IFA. A Laboratory-wide effort is underway to correct deficiencies of this nature. • In general, chemical safety was satisfactory, but some issues were noted, such as improper secondary containment, clutter in fume hoods, and labeling deficiencies. • Several pieces of equipment (band saws, mills, belt sanders, and drill presses) had exposed moving parts.
EH&S	Division SA	• Line management commitment is strong. Management participates in the Division Safety Committee, workplace inspections, safety hazard tracking and control, and the ergonomics program. • The Accident Review Board is effective in reviewing injuries, root causes, and corrective actions.	• An RWA noncompliance resulted in three major violations. • Although commitment to controlling ergonomics hazards is strong (as evidenced by the high completion rate of EHS060 and EHS068), Division staff incurred two ergonomic-related recordable injuries.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Facilities	Division SA	• The Division Director is very involved in the safety program, holding semiannual all-hands meetings, and emphasizing a zero accident goal. The Director also holds monthly executive safety meetings with the three department heads. • Considering the myriad of field activities that Facilities engages in, the Division does a commendable job of mitigating hazards.	• Workspace inspections and hazard reviews have improved in recent years. However, due to the multiple forms of inspection and review, the Division cannot provide assurance that all areas are inspected and all significant activities are reviewed for hazards. Also, all inspection findings should be tracked in LCATS. • Significant resources have been devoted to ergonomic hazards. However, only 25% (15 out of 59) of candidate workstations have been evaluated for ergonomic hazards. • Facilities improved both the recordable injury and lost-work- time injury rates this year, by 14% and 11% respectively. However, this is a continued area of emphasis, as further improvement is warranted.
	MESH	• The Division Safety Coordinator meets with all new hires to discuss the importance of safety. By meeting with hires during their first week of employment, the safety coordinator communicates the priority the Division places on working safely. • Facilities has a well-developed system of ES&H communication that employs several different methodologies to engage staff. The three safety committees promote two-way	• Facilities should formalize the role that contractors' safety performance plays in awarding contracts. The Division could not demonstrate that competing contractors are evaluated for safety performance and that this evaluation carries weight in the awarding of contracts. If this evaluation is performed, it should be documented for consistency and future reference.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Facilities (continued)		safety communication between management and staff. The Division also uses electronic message boards, newsletters, and award lunches to raise safety awareness. • An EH&S Division professional is matrixed to Facilities to review purchase order contract projects on an ongoing basis. This individual visits job sites each day to review work performed by contractors and Facilities Division staff. One contractor's crew noted the positive influence this has had on the safety of their activities. • The WOW program is an important component of worker safety by increasing staff safety awareness. The program identifies systemic safety issues and attempts to modify behaviors to address deficiencies. Recently, supervisors have also begun performing observations, which appears to have strengthened the program. • Regular, semi-monthly executive walkthroughs performed by the Division Director and Division Deputy demonstrate management's commitment to safety. Recognizing that their staff performs highly hazardous work, Facilities Division management inspects workspaces more frequently than any other division management at the Laboratory.	• Small work orders generated through MAXIMO appear to bypass the design review step, where potential building code violations and OSHA violations can be properly identified and addressed. This results in work performance that potentially violates present building codes and OSHA standards. • Hazards for small jobs initiated through maintenance activities and the Work Request Center are not communicated to line workers. Job work orders list hazards of work locations from the HEAR database, but this documentation is not provided to the workers. Documentation detailing hazards should be passed directly to workers. • In response to an OSHA inspection finding to enhance LOTO safety, an additional electrical switch was installed on a panel saw. As a result, blade changes on the panel saw require two electrical switches to be turned off. However, neither switch can be locked out. Therefore, the newly installed switches do not meet the OSHA requirement that they be lockable. • The Building 76 carpenters' shop lacks appropriate administrative hazard controls. The shop does not have a formally designated supervisor. The shop machinery has no written procedures for use or LOTO.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Facilities (continued)			• MESH inspections of Facilities Division workspaces noted several safety concerns, including daisy-chained electrical cords, abundant use of extension cords in lieu of permanent wiring (creating trip hazards), improper compressed gas storage, and improper waste storage. Many of these issues were obvious, prompting concern about the ability of Facilities staff performing workspace inspections to identify safety hazards. • Findings from executive safety walkthroughs and WOW observations are not entered into LCATS. The MESH team observed several safety concerns previously detected during an executive safety walkthrough that remained unresolved after several months. Entering these findings into LCATS will ensure that they are properly tracked and resolved. • Completed work is not regularly inspected for safety compliance. The Division should approach their work from the perspective that a job is not completed until a post-work safety inspection is performed. Documented inspections would identify Facilities work that violates OSHA rules or building standards.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Life Sciences	Division SA	• Principal investigators and the Division Safety Coordinator annually complete the Space Hazard Database for all Division workspaces. This process ensures that line managers are inspecting their workspaces and provides a comprehensive inventory of hazards. • Life Sciences hosted two vendors' fairs in the past year to display ergonomically friendly lab equipment. • The Division Safety Coordinator maintains a spreadsheet of all peroxide-forming chemicals and the dates they were tested. • Life Sciences has been highly successful in reducing waste generation. Mixed waste generation decreased from 116 liters in FY03 to 12.5 liters in FY04. Photochemical waste in Building 83 was reduced from 167 liters to 0 liters.	• Life Sciences Division has 44 formal authorizations. Renewal dates for these authorizations should be tracked on a spreadsheet. The Safety Coordinator maintains a binder of all authorizations, but this does not ensure that all authorizations are renewed on schedule. • The division experienced an increase in recordable injuries to staff, although the lost workday case rate remains low.
Materials Sciences	Division SA	• Formal authorizations are well tracked, and all 34 formal authorizations were renewed on schedule. • MSD has completed workstation evaluations for 74 employees. The Division also makes a concerted effort to train staff members to perform evaluations, ensuring that more staff will receive future evaluations. • MSD systematically identified, tested, and labeled their peroxide-forming chemicals.	

Division	Review	Noteworthy Practices	Opportunities for Improvement
Materials Sciences (continued)		• The Division Director and Deputy are actively involved in the division safety committee. • MSD recorded 125 safety deficiencies in LCATS, with 100% resolved.	
Nuclear Science	Division SA	• Hazard review of self-authorized work is thorough. This process is completed for all projects (by completing Project Safety Review Questionnaires) and for all workspaces (by updating the HEAR database). These complementary processes ensure that all lower level hazards are identified and controlled. • Nuclear Sciences had zero recordable or lost-work-time injuries for the 2004 fiscal year.	• The Division continues to struggle with RWA violations. While the division only had one compliance violation in FY04 (an improvement from four in FY03), it involved students not trained, not authorized, and working without supervision. This has been strongly addressed by the head of the 88" Cyclotron so that it does not happen again. • The Division has made great strides in completing EHS060 (Ergo for Computer Users), but it still lags in performing evaluations and implementing recommendations.
	MESH	• Nuclear Science has biweekly Division-wide meetings and weekly technical staff meetings at the 88" Cyclotron. Safety is a standing agenda item for both of these types of meetings. The regular focus on safety in these relatively frequent meetings demonstrates the priority that the Division has for safety. • The 88" Cyclotron Program Action Committee is an excellent review committee for beamline work at the facility. The committee reviews each research proposal and also provides	• Completing an MOU with the Engineering Division for matrixed employees was identified in the MESH review three years ago. The MOU is still recommended to establish clear roles and responsibilities, including training responsibilities, between NSD managers and matrixed employees from the Engineering Division. • Although ergonomics has been identified as a significant hazard/risk for the Division, the systematic evaluation of workstations and

Division	Review	Noteworthy Practices	Opportunities for Improvement
Nuclear Science (continued)		researchers with useful information on safety training and administrative requirements prior to their performing work. • The Division has done a commendable job in reviewing and updating formal authorization projects and lower hazard projects. All projects have been reviewed in a timely manner. Of particular note, the review of lower hazard projects, which has been problematic in other divisions, demonstrates that NSD has a systematic process through its Project/Facility Safety Review Questionnaire and safety committees. • Documentation for the authorized work in the Heavy Element Nuclear and Radiochemistry Group is well organized and maintained. The principal investigator filed in a single binder his list of personnel, radiation work authorizations, training status of employees, guests, and students, including documentation of their on-the-job training, and other pertinent safety information. The binder is reminiscent of the "Project Notebooks" used ten years ago. Other LBNL labs should consider resurrecting Project Notebooks using this format. • The Division eliminated all mixed waste generation from its operations. In fiscal year 2002, NSD generated approximately 40 kilograms (56 liters) of mixed waste. By eliminating and modifying some research	other ergonomic risks is progressing slowly. • A significant number of cabinets and other equipment in NSD space are not seismically braced. The Division should focus on securing cabinets and other large items during this year's self-assessment inspections. • Although the Division has improved its usage of LCATS to track corrective actions of its ES&H deficiencies, significant inconsistencies remain in retrieving complete, accurate, and up-to-date information on corrective actions. For example, NSD has LCATS entries for only calendar years 2002 and 2004 (there are no 2003 entries). Of the 63 entries in 2002, only 19 corrective actions have been closed out.

Division	Review	Noteworthy Practices	Opportunities for Improvement
Nuclear Science (continued)		activities, the Division generated no mixed waste. • The Chair of the NSD Safety Committee is commended for personally checking the status of JHQs for all NSD personnel, and for contacting supervisors in cases where employees' JHQs are not completed. Such action is an example of senior management involvement and commitment to safety.	

Division	Review	Noteworthy Practices	Opportunities for Improvement
Physical Biosciences	Division SA	• Physical Biosciences has a history of placing ES&H considerations as a priority in allocating resources. Significant resources have been directed to clean all of Calvin Hall to address legacy materials hazards, provide GERT training for contractors and UCB personnel, purchase ergonomic equipment, and institute better engineering controls. • PBD has an excellent safety organization that is proactive and effective in assuring that safety is integrated into Division operations and activities. • Satellite accumulation areas are inspected weekly by the Division Safety Coordinator or assistant. • Each staff member completes a personal safety checklist as a ticket for the Division picnic. This has proven very successful, as over 90% of staff complete these self-assessment reviews.	
	IFA	• PBD recorded 109 safety deficiencies in LCATS, with 100% resolved. • PBD assures that personnel assigned to work in campus locations (not in Calvin Laboratory) are tracked and receive the appropriate LBNL training. This practice puts the Division in a very favorable position as the revised LBNL/UCB Partnership Agreement on EH&S	• Some computer workstations associated with research laboratories and in PBD offices are not well designed ergonomically. In addition, researchers could benefit from improved workstation design and ergonomic practices involving laboratory microscopes. • In some instances, high-electrical-load lab

Division	Review	Noteworthy Practices	Opportunities for Improvement
Physical Biosciences (continued)		Policies and Procedures is implemented. This MOU establishes additional provisions for training of LBNL personnel in UCB locations. • The Division Safety Team is especially proactive in identifying and correcting ES&H concerns. This is evident in improvements in chemical safety, gas-system pressure relief, and PPE since the 2001 IFA. • The Safety Team is especially effective working with the Division Safety Committee representatives and Division management to affect change and enhance awareness and understanding of important ES&H issues. • PBD has maintained a high level of achievement in waste and training compliance.	equipment (e.g., chromatographs, spectrometry workstations) was connected to relocatable power taps (RPTs or power strips) in lieu of being connected to permanent electrical outlets. This situation calls for an increase in the dedicated electrical service capacity and/or reconfiguration of the current electrical connections. • This appraisal found instances of blocked electrical service panels, disconnects, and emergency eyewash and shower installations. It is critical that proper clearance be maintained to allow for proper access to these items for operational and safety purposes. • Numerous pieces of lab and office equipment (e.g., freezers, file cabinets, and bookcases) were not secured for seismic purposes. In addition, large portable cryogen dewars of a few installations were not secured against seismic movement. • Some of the areas with large inventories of cryogens (on the order of 100 liters or more) do not have sufficient volume or robust enough ventilation systems to prevent the significant reduction of room-air oxygen content upon accidental release. EH&S will work with experimenters in these areas to develop solutions to reduce the cryogen

Division	Review	Noteworthy Practices	Opportunities for Improvement
Physical Biosciences (continued)			inventory to safer levels or to install monitoring or ventilation upgrades to accommodate research activities.
Physics	Division SA	• Physics had zero recordable or lost-work-time injuries for the 2004 fiscal year. • Management has an active role in the division ES&H program. Division management participates in safety communication, workspace inspections, and hazard review. Safety is also addressed at group leader and Physics Management Meetings. Also, the Division Director has inspected staff workspace. • A dedicated training class was held to address ergonomic hazards in microscope use.	• Physics does not use LCATS. Safety deficiencies are not effectively tracked and resolved. • While progress was made on some of the findings from the 2003 fiscal year findings, not all issues were resolved (for example, the Division still doesn't have an effective system to track implementation of corrective actions). • Physics should place greater emphasis on conducting ergonomic evaluations.
PGF	Division SA	• Genomics has an excellent ES&H communication system. The safety committee and line management play active roles in communicating safety to staff. All supervisors are required to have one-on-one safety meetings with new employees, as documented in a Division-specific new employee checklist. • Ergonomic hazards are a focus at PGF. Significant resources are allocated to perform workstation evaluations and purchase ergonomic upgrades.	• The annual renewal of a laser activity hazard document is overdue by nine months. • PGF staff had two lost-work-time injuries during the fiscal year.

Appendix D

List of Acronyms and Abbreviations

AFRD	Accelerator and Fusion Research Division
AHD	Activity Hazard Document
ALS	Advanced Light Source
ASD	Administrative Services Department
BBAP	Behavior-Based Accident Prevention
CSD	Chemical Sciences Division
DART	Days Away from work and Restricted Time
DOE	Department of Energy (U.S.)
EETD	Environmental Energy Technologies Division
EH&S	Environment, Health, and Safety Division (LBNL)
ESD	Earth Sciences Division
ES&H	Environment, Safety, and Health (DOE term)
HEAR	Hazards, Equipment, Authorizations, and Review System
IFA	Integrated Functional Appraisal
ISM	Integrated Safety Management
JHQ	Job Hazards Questionnaire
LCATS	Laboratory Corrective Action Tracking System
L'OASIS	Lasers, Optical Accelerator Systems Integrated Studies
LOTO	Lock-out/Tag-out
LSD	Life Sciences Division
LWC	Lost Workday Cases
MESH	Management of ES&H
MOU	Memorandum of Understanding
MSD	Materials Sciences Division
MWSAA	Mixed Waste Satellite Accumulation Area
NCAR	Nonconformance and Corrective Action Report
NFPA	National Fire Protection Association
NSD	Nuclear Science Division
OAA	Office of Assessment and Assurance
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
OSSEP	Off-Site Safety and Environmental Protection Plan
PBD	Physical Biosciences Division
POCMs	Performance Objectives, Criteria, and Measurements
PI	Principal Investigator
PPE	Personal Protective Equipment
PGF	Production Genomics Facility
QUEST	Quality Assurance/Improvement and Environment, Safety, and Health through Self-Assessment and Teamwork
RWA	Radiological Work Authorization
RMCA	Radioactive Waste Collection Area
RWP	Radiological Work Permit
SAA	Satellite Accumulation Area
SAAR	Supervisor Accident Analysis Report

SRC	Safety Review Committee
SSA	Sealed Source Authorization
TRC	Total Reportable Cases
UCB	University of California at Berkeley
UCOP	University of California Office of the President
WOW	Workers Observing Workers
XSD	X-Ray Machine Safety Document